Self Assessment of HIV Risk Among OSU Students

Honors Research Thesis

Presented in partial fulfillment of the requirements for graduation *with honors research distinction* in the undergraduate colleges of The Ohio State University

Anna Askari

The Ohio State University
April 2013

Project Advisor: Professor Abigail Norris Turner, Department of Internal Medicine, Division of Infectious Diseases

Abstract

***Background*:** HIV testing helps prevent the spread of HIV in at-risk populations, including among students on a college campus. The HIV testing process includes education and behavioral counseling to help individuals make better decisions about high-risk behaviors. HIV is on the rise among adolescents aged 13 to 24 in the U.S, and the college campus environment provides many opportunities to participate in high risk behaviors. Research that examines students' perception of their personal risk of HIV acquisition is needed.

Objectives: The purpose of this study is to evaluate whether Ohio State University (OSU) students (n=1000) who come for HIV testing at OSU's Student Wellness Center (SWC) classify their risk for HIV acquisition differently compared to how their HIV counselor classifies them. This study will provide insight as to which groups of students seeking HIV testing at OSU underestimate their HIV risk. Identifying these students can help the SWC target those who may be discordant with their counselors to encourage them to take advantage of HIV testing and counseling.

***Methods*:** We compared risk assessments reported by students prior to counseling ('low,' 'medium,' or 'high') on a self-administered, paper survey to the risk assessment reported by their counselor (also 'low,' 'medium,' 'high'), and evaluated whether differences in risk perception between students and counselors were associated with demographic or behavioral factors. Participants were not recruited for this study; instead, we utilized a de-identified database provided by the SWC HIV testing and counseling program. The OSU IRB approved this research.

***Results*:** The population included 1000 students seeking HIV testing, the majority of whom were undergraduate (76.1%), male (59.1%), and White (68.8%). Most students (75.5%) self-reported their risk as 'low,' whereas 21.4% selected 'medium' and 3.1% selected 'high.' In contrast, counselors rated students' risk as 'low' for 45.7% of students, 'medium' for 34.7%, and 'high' for 19.5%. Most students (65.2%) had excellent knowledge of HIV transmission routes and risk behaviors, while 27.7% and 6.7% had good and poor knowledge respectively. Most students' risk assessments (51.1%) were concordant with their counselor's risk assessment, while 6.2% and 42.6% were discordant (overestimation) and discordant (underestimation) respectively.

Conclusion: In this study, we looked at whether OSU students who participate in HIV testing and counseling at the SWC assess their risk for HIV in a different way from what their counselor assesses their risk to be. In particular, we focused on students who *underestimated* their HIV risk. We were interested in determining specific demographic and behavioral characteristics of those students whose risk assessments were discordant with their test counselor's assessment. Our findings suggest that risk discordance between counselors and students is common. The characteristics that were associated with increased odds of risk discordance are being students who do not identify as heterosexual, having sex while under the influence of alcohol in the last 12 months, having 3 or more sexual partners in the last 12 months, and being sexually assaulted in the last 12 months.

Introduction

HIV: a brief history

Since it was first discovered, human immunodeficiency virus (HIV) has presented the world with a continuing challenge to prevent further infection of at-risk individuals. In 1981, the Centers for Disease Control (CDC) reported five cases of young males with *Pneumocystis carinii* pneumonia (PCP) in Los Angeles as well as an outbreak in New York City of a rare form of cancer – later identified as Kaposi's Sarcoma – among young gay males (CDC MMWR 1981). In 1984, Dr. Robert Gallo of the National Cancer Institute, Dr. Luc Montagnier at the Pasteur Institute in Paris, and Dr. Jay Levy at University of California San Francisco separately discovered and named what became known as HIV (In Their Own Words). A year later, Gallo confirmed HIV to be the cause of Acquired Immune Deficiency Syndrome (AIDS). This virus can infect the rich, poor, sick, healthy, young, and old no matter where they live. It is not a gay or African disease as was believed during the 1980s.

Although there are improved treatment options to help those infected with HIV live longer and healthier lives, there is still no cure and treatment is expensive (Kamb, Fishbein, Douglas, et al. 1998). HIV can be transmitted in four ways: through sexual contact with an HIV-infected individual; through use of needles contaminated with HIV-infected blood; through blood transfusion or organ donation from an HIV-positive donor; and during pregnancy or breastfeeding via vertical transmission from an HIV-infected woman. HIV destroys the body's CD4+ T-cells, a type of white blood cell that helps the body fight disease. Once the CD4+ T-cell count falls below 200 cells/mm^3 of blood and if certain AIDS-defining illnesses appear, such as Kaposi's sarcoma or *Pneumocystis* pneumonia, the infection is considered to have progressed to AIDS.

HIV Testing

HIV testing and counseling is one of the most important ways to prevent the spread of this virus. In 1985, the first test for HIV was approved in order to test the blood supply. Eventually, there was a demand from individuals who wanted to be tested for HIV (Branson, Handsfield, Lampe 2006). Also during that year, the CDC developed guidelines for HIV counseling to be given along with the test. The goal was to prevent the spread of the virus by helping infected and uninfected individuals identify risky behavior, and to begin to change those behaviors through personalized risk reduction planning in order to avoid infecting others (CDC 1993). Since the first HIV tests were made available, the CDC has changed their HIV test counseling guidelines several times.

In 1986, the CDC recommended that HIV test counseling be available to any high-risk individuals as part of routine testing offered in health care settings such as, "…sexually transmitted disease (STD) clinics, clinics for treating parenteral drug abusers and clinics for examining prostitutes" (CDC MMWR 1986). These guidelines also underscored the importance of testing being voluntary and confidential. In 1987, the United States Public Health Service issued new guidelines that made HIV testing and counseling a prevention tool for those specifically practicing high-risk sexual behaviors and those who present for Sexually Transmitted Infections (STI) treatment at any healthcare setting (Branson, Handsfield, Lampe 2006). This was the first time that HIV counseling was used as a prevention tool by targeting

high-risk groups. That same year, the CDC's new guidelines highlighted the importance of decreasing the stigma of disclosing personal information during a counseling session, as well as reducing the barriers to receiving HIV test counseling (CDC 1987). At a Conference on HIV Counseling and Testing in 1988, the CDC concluded that all individuals who participate in high-risk behaviors should have access to voluntary testing and counseling (Cates & Handsfield 1988).

The CDC first defined the term, "client-centered counseling" in their revised guidelines in 1993. The goal of this new interactive format of counseling was to encourage the client to make more realistic behavior changes to reduce their risk of acquiring or transmitting HIV. This kind of test counseling was to be geared towards the unique needs of each client (CDC 1993). The CDC provides several justifications for HIV testing and counseling. First, an individual can be infected with the virus for many years without symptoms. Second, HIV screening is relatively inexpensive, noninvasive, and reliable. Third, getting treatment earlier in the course of the disease rather than initiating treatment during the later stages can prolong a patient's life. Finally, the anticipated benefits of HIV testing, such as preventing the spread of this virus to non-infected individuals and getting treatment to those already infected, are worth the financial costs associated with testing (Branson, Handsfield, Lampe 2006).

In 1994, the U.S. Food and Drug Administration (FDA) approved oral fluid HIV testing, which helped expand testing to sites that were unable to handle blood sampling (Greenwald, et al. 2006). This test is still used today in non-clinical settings such as college campuses, mobile testing units, and churches as a way to offer faster and more convenient testing and counseling to at risk individuals. Non-clinical settings provide access to testing for individuals without healthcare, those who have never been tested for HIV and those at high risk who would benefit from regular testing. HIV test counseling is considered an effective tool for reducing the risk of HIV, but CDC states that it should be used in conjunction with other programs to target at-risk populations in order to effectively address the HIV epidemic.

Literature Review

Researchers in the past have attempted to evaluate the efficacy of HIV test counseling, but they have been limited. Project EXPLORE was a randomized clinical trial of men who have sex with men (MSM) designed to evaluate the impact of HIV counseling on HIV incidence rates (Koblin, Chesney, Coates, 2004). The intervention for this project was individually tailored counseling, which allowed counselors to emphasize existing safer sex practices to study participants (Chesney, Koblin, Barresi, Husnik, Celum, Colfax, et al. 2003). Their results suggested that this kind of intervention had a fairly modest effect in preventing HIV infection, and decreased high-risk behavior among participants (Chesney, Koblin, Barresi, Husnik, Celum, Colfax, et al. 2003).

Another study published in 2002 compared the beliefs and risky behaviors of college students who did or did not seek HIV testing and counseling (Mattson 2002). The researcher found that after the counseling session, students' perception of HIV risk influenced their decision to adopt safer-sex practices for both vaginal and oral sex (Mattson 2002). The results also confirmed that HIV-test counseling has a positive impact on HIV/AIDS education and self-reported safe sex behaviors for students who present for testing (Mattson 2002). A study published in 2011 concluded that although many college students are aware of high-risk behaviors leading to HIV

infection, they continue to put themselves at risk. The authors conclude that colleges and universities should be more attentive in their intervention and targeting efforts (Iconis R 2011).

There are two schools of thought when it comes to HIV test counseling. Some follow a protocol for collecting risk data on the client followed by a general overview of HIV prevention, while others create an interactive counseling experience aimed at personalized risk assessment and reduction (Kamb, Fishbein, Douglas, et al. 1998). According to the CDC, the latter is referred to as a client-centered counseling approach which includes assessing the client's risk and recognizing specific behaviors that increase risk, creating a personalized risk reduction plan to take specific steps to reduce this risk, and making appropriate referrals to resources that the student may need. The goal is to provide counseling to encourage clients to change their behavior to avoid infection or, if already infected, avoid transmitting HIV to others. Project RESPECT was a randomized controlled trial that looked at the effect of HIV counseling on reduction of risky behavior and prevention of HIV and other STIs (Kamb, Fishbein, Douglas, et al. 1998). The study compared three different HIV test counseling approaches: (1) HIV educational intervention; (2) HIV client-centered prevention counseling; (3) Enhanced HIV prevention counseling (Kamb, Fishbein, Douglas, et al. 1998). Their conclusion was that client-centered and interactive test counseling resulted in a 30% decrease in STI occurrence after 6 months and 20% decrease after 12 months of follow up (Kamb, Fishbein, Douglas, et al. 1998).

HIV testing technology has advanced over the years, making it easier and more efficient to test high-risk groups including college students. Typically HIV test counseling occurs after the client's biological sample (blood or saliva) has been collected, while the test itself is processing and before the HIV results are known. There are two types of HIV testing: conventional and rapid. The conventional testing involves the ELISA/Western Blot. It is a blood test or oral sample known as the enzyme immunoassay (ELISSA). This type of test counseling typically requires two visits: (1) pre-test counseling along with the administering of the test and (2) delivery of results, post-test counseling, and medical referrals. The rapid antibody testing involves oral fluid, a finger-stick sample of blood, or plasma. The HIV testing and counseling includes a pre-test and post-test session done in one visit along with the test and delivery of results and medical referrals. Pre-test counseling sessions generally include information about the HIV test, HIV transmission, confidentiality, and explanation of possible test results. Once the result is given, post-test counseling generally includes communication about the meaning of the test result, prevention counseling if results are negative or confirmatory testing if results are preliminary positive. During these counseling sessions, the client assesses their own risk for HIV transmission while the counselor also assesses their risk based on the information obtained during the counseling session. This counseling can be crucial to help high risk students learn more about high-risk behaviors. Clients' perception of their own risk is important in determining why HIV is still spreading in high risk groups, such as college students, in the United States.

According to one study looking at HIV prevalence and risk factors, college students who were more open to HIV testing were at lower risk for HIV infection than those who chose not to be tested (Raab, Burns, Scott 1995). Students who receive risk-reduction counseling can then begin to think about behavior changes that will lower their HIV risk. Reaching out to high-risk students is an important part of the HIV prevention efforts, because HIV acquisition can be prevented by appropriate behavioral changes. College students may perceive themselves at low risk for

contracting HIV (Lewis, Malow 1997). Other researchers who looked at the effects of HIV counseling and testing on sexual behavior concluded that there is a need for more research looking at the conditions under which HIV testing and counseling is effective in reducing risky behaviors (Weinhardt, Carey, Johnson, Bickham 1999). However, if high-risk individuals, such as college students, do not think they are at high risk of HIV then they will falsely believe that they are safe from HIV infection (Hernandez, Smith 1990).

The environment of a college campus provides many opportunities to participate in high-risk behaviors such as unsafe sexual practices and having multiple sex partners (Adefuye, Abiona, Balogun, Lukobo-Durrell 2009). Students are more likely than other population groups to have sex while under the influence of alcohol and other drugs. Although the spread of HIV has decreased recently in the US, it is on the rise for adolescents (ages 13-24), at least in part because they are more likely to participate in higher risk behaviors (Adefuye, Abiona, Balogun, Lukobo-Durrell 2009). Another group of researchers that looked at transmission of HIV among college students in the Southeastern United States found that there is a need to better understand the unique factors that make college students a high risk group (Hightow, MacDonald, Pilcher, et al. 2005). One study of college students at a private college also found that even though students were knowledgeable about their risk of how the virus is transmitted, they were not worried about becoming infected and did not take necessary precautions (Opt and Loffredo 2004).

Objectives

There is currently a lack of research looking into relationships between various demographic characteristics, self-reported behaviors, and perception of HIV risk among college students. If students are at high risk of HIV acquisition, but perceive themselves to be at low risk, then they may continue behaving in a high risk manner and could later become infected. The purpose of this study is to examine whether Ohio State University (OSU) students who present for HIV testing and counseling at the Student Wellness Center (SWC) classify their risk for HIV acquisition differently compared to what their HIV counselor classifies them; in particular, we focused on students who *underestimated* their HIV risk. The hypothesis is that student demographic and behavioral factors may predict this type of discordance between student and counselor-risk assessments. This study provides insight as to which groups of students at OSU underestimate their HIV risk. It is important to address discordance between student- and counselor-risk assessments. Identifying students who believe that they are at lower risk than what their counselor identifies them as can help the SWC better target those who may benefit from HIV testing and counseling available on campus. Recognizing certain demographic characteristics of students with discordant risk assessments can also make it easier for the SWC to advertise its HIV test counseling service in order to reach more of those students who may need it.

Methods

Procedure and Research Design:
This study was conducted at OSU's Student Wellness Center (SWC), located at 337 W. 17th Avenue in Columbus, Ohio. The SWC is the university's wellness department. Approval to carry out this study was obtained from OSU's Institutional Review Board (IRB). There was no direct interaction with participants for this study. Instead, information from students who had previously presented for HIV testing at the SWC was utilized. The HIV testing site coordinator, Dr. Katye Miller, merged monthly databases from July 1, 2010 through September 30, 2012. The sample size was 1000 OSU students who had presented to the SWC for HIV testing and counseling. The only criterion for participation was being an OSU student who had presented for HIV testing to the SWC.

The HIV test counselors at the SWC are student volunteers who attend a two-day training session where they learn how to: administer HIV tests; improve students' perception of risk; identify risk behaviors; negotiate a reasonable and realistic plan to help reduce risk; support the student in making a decision about testing and preparing for the result; and help the student who tests to begin to understand the result emotionally, behaviorally, and socially.

Students who wish to be tested for HIV make an appointment or come in for walk-in testing at the SWC. During the session, the student and counselor first review a consent form that the student signs and dates if testing confidentially or dates if testing anonymously. Prior to any counseling or educational activities, the OraQuick Advance Rapid HIV-1/2 Antibody test is administered as an oral swab. This test takes 20 minutes to process. During that time, the student fills out a self-administered questionnaire collecting demographic and sexual behavior information. Table 1 shows the variables that were analyzed in this study:

Table 1: Study Variables

Variable	**Response Options**
Age (years)	[not limited]
Gender	Male, Female, Transgender (male to female), Transgender (female to male)
Rank	1st, 2nd, 3rd, 4th, 5th, Graduate/Professional, Other
Ethnicity	Hispanic or Latino, Not Hispanic or Latino, Don't Know
Race	American Indian/Alaskan Native, Asian, Black/African American, Native Hawaiian/Pacific Islander, White, Don't Know, Declined
Sexual Orientation	Bisexual, Gay/Lesbian, Heterosexual, Unsure/Questioning, Other
Relationship Status	Dating, Divorced/Widowed, Married/Domestic Partner, Single, Engaged, Other
Relationship Type	Not in a relationship, Mutually monogamous, Open relationship, Other
HIV test before (last 12 months)	Yes, No, Don't Know
Would test confidentially	Yes, No

Variable	**Response Options**
Number of sex partners (oral, anal, and vaginal in last 12 months)	None, One, Two, Three to Five, Six or more
Positive for STI (last 12 months)	Yes, No, Not sure
Sexually assaulted (last 12 months) (*self-reported*)	Yes, No
Had sex under influence of alcohol (oral, anal, and vaginal in last 12 months)	Yes, No
Had sex under influence of non-injection drugs (oral, anal, and vaginal in last 12 months)	Yes, No
Had sex with a man who has had sex with another man (MSM) (in last 12 months)	Yes, No
HIV knowledge level	Excellent, Good, Poor
Student risk assessment	None, very low, low, low-medium, medium, medium-high, high, very high
Counselor risk assessment	None, very low, low, low-medium, medium, medium-high, high, very high

After the student completes the self-administered questionnaire, the HIV test counselor reviews the questionnaire with the student and provides referrals to campus resources and information about how to reduce risky behaviors. The HIV test counselor helps the student create a behavioral risk assessment and plan to reduce his/her risk of acquiring HIV. Then the test result is given to the student. The HIV test counselor then reviews the personalized self-risk assessment plan with the student to remind them of what they discussed to conclude the session.

After the appointment, the HIV test counselor enters data from the self-administered student questionnaire into an Excel spreadsheet. Every month, Dr. Miller runs a quality assurance (QA) protocol on the data recorded in the Excel spreadsheet, and enters any student data that was not entered directly by the HIV test counselors. This QA protocol includes cross-referencing paperwork completed by the HIV test counselor and student with the data recorded in the Excel spreadsheet.

Data Analysis

All personal identifiers were removed from the SWC's HIV test counseling database for this analysis. Data were analyzed using Statistical Package for Social Sciences (SPSS) version 20. The database for this study did not have a large number of missing data points. Most of the variables were missing between 1 and 4 values (0.1% to 0.4%). The variables with the largest number of missing values were ethnicity (7.4%), marital status (1.9%), relationship status (1.3%), and previous HIV test (1.6%). All of the variables were re-coded to account for missing and declined responses. The data were summarized using descriptive and inferential statistics.

HIV test counselors assess the student's risk for HIV transmission based on specific guidelines as suggested by Dr. Miller. These guidelines are based on CDC risk populations in the U.S., and can be found in Table 2.

Table 2: Risk Assessment Guidelines

Risk Assessment[1]	***Rationale***
No Risk	▪ Have never been sexually active or shared needles
Low Risk	▪ Good communication with their partners (about partner's HIV status, sexual history, use of barrier methods for HIV prevention, and testing history) ▪ Always use condoms for vaginal and/or anal sex ▪ Have between 0-2 sexual partners in the last 12 months ▪ Report being in a mutually monogamous relationship ▪ Do not engage in injection drug use or use of alcohol or other drugs that would affect sexual behavior
Medium Risk	▪ Decent communication with their partners (do not know about partner's HIV status or testing history) ▪ Sometimes use condoms for vaginal sex ▪ Have between 1-3 sexual partners in the last 12 months ▪ Report infidelity occurring in a relationship ▪ Alcohol and non-injection drug use may influence sexual behavior
High Risk	▪ Lack of communication with their partners (about partner's HIV status, sexual history, use of barrier methods for HIV prevention, and testing history) ▪ Never use condoms for vaginal and/or anal sex ▪ Have 3 or more sexual partners in the last 12 months ▪ Have unknown/anonymous partners ▪ Report sharing needles or using alcohol or other drugs that played a role in sexual activity ▪ Exchange sex for goods/services/products

[1] Condom usage is the biggest indicator of risk determination

Typically, low risk students report having one sexual partner in the last 12 months; always using a condom for vaginal and/or anal sex; and not engaging in any alcohol or drug use. Typically medium risk students report having 2-3 sexual partners in the last 12 months; sometimes using a condom for vaginal sex; and engaging in alcohol or non-injection drug use. Typically high risk students report having 3-5 sexual partners in the last 12 months; never use a condom for vaginal sex while sometimes or never using a condom for anal sex; and engaging in alcohol/drug use and/or sharing needles.

Due to HIV test counselors' input, the risk categories were expanded to allow more nuance in capturing students' risk. Dr. Miller changed the risk assessment for the students based on what they were providing in the questionnaire. A good number of students circled two different risk assessments (i.e., low-med), but the HIV test counselors choose their own risk assessment – the guidance is for low, medium, and high risk – HIV test counselors choose to combine risks if they feel the client is between two risk categories. For instance, if a student has one sexual partner in

the last 12 months, never uses a condom, and has limited communication a counselor may choose a low-medium risk due to the low number of partners (low risk), never using a condom (medium risk; maybe high, depending on more information), and limited communication (medium risk). The combining of the categories is the decision of the HIV test counselor, which makes the construct subjective. HIV test counselors can choose one of eight categories of risk assessment: none, very low, low, low-medium, medium, medium-high, high, and very high. For this analysis, we collapsed these seven categories into three (low, medium, high). The revised low category includes the none, very low, and low risk assessments. The medium category combined the low-medium and medium risk assessments. The high category combined the medium-high, high, and very high risk assessments.

Table 3 shows the frequency and percentage of the demographic and behavioral variables of the 1000 students receiving HIV testing at the SWC. Table 4 shows the frequency and percentage of the behavioral variables (HIV test before, oral/anal/vaginal sex while under the influence of alcohol in the last 12 months, reporting sex with MSM in the last 12 months, tested positive for STI in the last 12 months, sexually assaulted in the last 12 months) of the students stratified by several demographic variables (age, gender, sexual orientation, race).

Tables 5 and 6 were stratified by sex; due to the small response (n=5) transgendered individuals were excluded from the median and IQR analyses. Data in these tables were stratified by age, sexual orientation, race, and number of sexual partners in the last 12 months. Median student and counselor risk assessments were assessed along with the interquartile ranges (IQRs).

Table 7 shows the student's knowledge level as reported by the counselor as "excellent", "good", or "poor". The data were stratified by age, sexual orientation, race, number of sexual partners in the last 12 months, and HIV test before. This is the most subjective variable in the study. This rating is based on answers to the following two questions found on the student's questionnaire (correct answers are bolded for the purpose of this thesis):

"Which fluids are documented routes of transmission for HIV (proven ways a person can get HIV)?"

Blood, Saliva, Tears, **Semen**, **Vaginal secretions**, **Breast milk**, and Urine/Pee

"Which have been documented as putting a person at high risk for acquiring HIV?"

Oral sex, Kissing, **Vaginal sex**, **Sharing needles**, Mosquito bite, Hugging, **Anal sex**, Donating blood, and **Blood transfusion (before 1985**).

The HIV test counselor rates the student as having "excellent" knowledge if the student knew the four correct infectious bodily fluids and the four correct transmission routes. Those with "good" knowledge knew most (2 to 3) correct infectious bodily fluids and 2 to 3 transmission routes. Students with "poor" knowledge did not know more than 1 infectious bodily fluid or more than 1 transmission route. The knowledge variable is subjective because the answers to these questions are discussed during the informed consent process. Some HIV test counselors assess students' knowledge before going through the consent form, and some assess knowledge after going through the consent form. Because of this variability, it is difficult to know which students

actually knew about transmission routes and behaviors before their appointment. As such, this variable was not extensively analyzed in our analysis.

Table 8 is a cross tabulation of the student and counselor risk assessments. The concordant students were those whose risk assessments agreed with their counselor's risk assessment. The discordant (overestimation) students were those who believed that they were at a higher risk than what their HIV test counselor believed. The discordant (underestimation) students were those who believed that they were at a lower risk than what their counselor believed. There were 5 students in the study who were missing risk assessments in the database. They were not included in this analysis.

In table 9, odds ratios (ORs) and 95% confidence intervals (CIs) were calculated as odds of discordance between student and HIV test counselor risk assessments according to various demographic and behavioral characteristics. Logistic regression models were used to compute ORs and 95% CIs. Discordance was modeled as a binary outcome. Demographic and behavioral characteristics examined included sex, race, ethnicity, sexual orientation, sex with MSM (in the last 12 months), oral/anal/vaginal sex while under the influence of alcohol (in the last 12 months), HIV test before, number of sexual partners in the last 12 months, age, rank, relationship status, relationship type, tested positive for STI (in the last 12 months), sexually assaulted (in the last 12 months), and non-injection drug use before oral/anal/vaginal sex (in the last 12 months). Unadjusted ORs for each variable were computed, and a single adjusted model included the complete list of demographic and behavioral variables except those with very small cell sizes (ethnicity, HIV test before, relationship status, tested positive for STI) to account for the effects of confounding variables. Figures 1 and 2 are forest plots of the unadjusted and adjusted ORs and 95% CIs of the association between student demographic and behavioral variables and the underestimation of HIV risk.

Results

Demographic characteristics (Table 3)

From July 1, 2010 through September 30, 2012, 1000 students underwent HIV testing at the SWC. The student's ages ranged from 17 to 51 years, with a mean age of 22.3 years. In the sample, 20.9% of students were between 17 and 19 years of age, 30.6% were 20-21 years, 22.4% were 22-23 years, 10.6% were 24-25 years, and 15.3% were 26 years and older. Undergraduate students made up 76.1% of the population while 23.8% were graduate or professional students. Men comprised 59.1% of the sample, and women and transgender students made up the remaining 40.3% and 0.5% respectively. White students made up 68.8% of the sample, while students of color made up 32.9% of the sample. Hispanic/Latino students made up 5.2% of the sample versus 87.9% of students who were not Hispanic/Latino. Heterosexual students made up 67.1% of the sample while 32.6% were Gay/Lesbian/Bisexual/Questioning (GLBQ). The majority of the sample was never married (95.1%) and not in a mutually monogamous relationship (53.6%).

Behavioral characteristics (Table 3)

Of the 1000 students tested, 2.5% had no sex (oral/anal/vaginal) partners, 49.9% had 1 or 2 partners, and 47.0% had 3 or more sex partners within the last 12 months. Of the tested students, 51.4% reported no prior HIV test. Less than one-quarter (23.6%) of male and female students reported sex with MSM. While 57.7% of students reported oral, anal, or vaginal sex while under the influence of alcohol within the last 12 months. There were 2.4% of students who disclosed that they had been sexually assaulted in the last 12 months. While 8.1% of tested students disclosed that they had previously tested positive for a sexually transmitted infection (STI).

Table 3: Demographic and behavior characteristics of students undergoing HIV testing at SWC (n=1000)

Characteristics	n	%
Age		
17-19	209	20.9
20-21	306	30.6
22-23	224	22.4
24-25	106	10.6
26-51	153	15.3
Missing	2	0.2
Rank		
1st Year	130	13.0
2nd Year	132	13.2
3rd Year	190	19.0
4th Year	222	22.2
5th Year	87	8.7
Graduate/Professional	238	23.8
Missing	1	0.1

Characteristics	n	%
Gender		
Female	403	40.3
Male	591	59.1
Transgender	5	0.5
Missing	1	0.1
Race[1]		
White	688	68.8
African American	199	19.9
Asian	108	10.8
American Indian/Alaskan Native	10	1.0
Native Hawaiian /Pacific Islander	12	1.2
Missing	19	1.9
Ethnicity		
Hispanic/Latino	52	5.2
Not Hispanic/Latino	879	87.9
Missing	69	6.9
Sexual Orientation		
Heterosexual	671	67.1
Gay/Lesbian	253	25.3
Bisexual	54	5.4
Unsure/Questioning	12	1.2
Other	7	0.7
Missing	3	0.3
Marital Status		
Single	543	54.3
Dating	408	40.8
Married/Domestic Partnership/Engaged	30	3.0
Missing	19	1.9
Relationship Status		
Not in a relationship	536	53.6
Mutually Monogamous	371	37.1
Open/Other Relationship	58	5.8
Other	22	2.2
Missing	13	1.3
# of Sex Partners in Last 12 Months[3]		
None	25	2.5
1-2 partners	499	49.9
3 or more partners	470	47.0
Missing	6	0.6

Characteristics	n	%
HIV Test Before		
Yes	470	47.0
No	514	51.4
Missing	16	1.6
MSM[2]		
Yes	236	23.6
No	762	76.2
Missing	2	0.2
Sex While Under Influence of Alcohol[3]		
Yes	421	42.1
No	577	57.7
Missing data	2	0.2
Sexually Assaulted in Last 12 Months		
Yes	24	2.4
No	973	97.3
Missing	3	0.3
Past STI[4]		
Yes	81	8.1
No	916	91.6
Missing	3	0.3
Knowledge Level		
Excellent	652	65.2
Good	278	27.8
Poor	67	6.7
Missing	3	0.3

[1]Categories do not sum to 100% as students were given the option to check all that apply
[2]Men who have sex with men, or women who have had sex with a man who has had sex with men
[3]Vaginal, anal, or oral sex within the last 12 months
[4]Self-disclosed previous positive STI test as well as students who have not been tested before for any STI

Sexual Behaviors by Demographic Information (Table 4)
When behavioral variables were stratified by age, we observed that older students were more likely to have been tested for HIV before. Half of students aged 20-21 reported having sex while under the influence of alcohol, and this behavior was less common among both older (24 years and older) and younger (ages 17-19) students. When stratified by age, the percentage of students who are MSM or have sex with MSM, have been sexually assaulted in the last 12 months, and have had an STI in the past 12 months were largely similar.

Stratification by gender showed that more men than women (54.1% vs. 38.6%) had previously had an HIV test. More men than women reported having sex while under the influence of alcohol (44.1% vs. 39.5% of women) and having sex with MSM (37.6% vs. 2.7% of women). More women than men reported being sexually assaulted in the last 12 months (5.7% vs. 0.2% of men) and having tested positive for an STI in the last 12 months (11.9% vs. 5.6% of men).

When stratified by sexual orientation, there was a higher percentage of heterosexual students compared to GLBQ students who reported sex while under the influence of alcohol (45.2% vs. 36.3% of GLBQ students). Heterosexual students were also more likely than GLBQ students to report sexual assault (3.1% vs. 0.9% of GLBQ students) and having tested positive for an STI in the last 12 months (8.4% vs. 7.7% of GLBQ students). More GLBQ students compared to heterosexual students reported prior HIV testing (63.3% vs. 40.3% of heterosexual students) and being MSM or having sex with MSM (69.6% vs. 1.3% of heterosexual students).

Finally, when stratified by race, we observed that compared to white students, more students of color reported having had an HIV test before (51.7% vs. 46.3% of white students) and having tested positive for an STI in the last 12 months (11.5% vs. 6.6% of white students). A higher proportion of white students compared to students of color reported having sex while under the influence of alcohol (46.8% vs. 33.0% of students of color), having sex with MSM or being MSM (27.1% vs. 17.8% of students of color), and having experienced sexual assault in the last 12 months (2.8% vs. 1.9% of students of color).

Table 4: Sexual behaviors of OSU students by demographic characteristics (N=1000)

Characteristics	HIV Test Before				Sex[1] while under influence of alcohol				MSM[2]				Sexually Assaulted[3]				Positive with STI[4]			
	Yes		*No*		*Yes*		*No*		*Yes*		*No*		*Yes*		*No*		*Yes*		*No*	
	n	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Age																				
17-19	52	25.7	150	74.3	75	35.9	134	64.1	48	23.0	161	77.0	5	2.4	204	97.6	8	3.8	201	96.2
20-21	110	36.5	191	63.5	153	50.0	153	50.0	66	21.6	239	78.4	9	2.9	297	97.1	25	8.2	280	91.8
22-23	116	52.5	105	47.5	107	47.8	117	52.2	50	22.3	174	77.7	6	2.7	217	97.3	19	8.5	205	91.5
24-25	73	68.9	33	31.1	33	31.1	73	68.9	26	24.5	80	75.5	4	3.8	102	96.2	14	13.2	92	86.8
26-51	118	77.6	34	22.4	52	34.4	99	65.6	46	30.3	106	69.7	0	0.0	151	100.0	15	9.9	136	90.1
Gender																				
Male	316	54.1	268	45.9	260	44.1	329	55.9	222	37.6	368	62.4	1	0.2	587	99.8	33	5.6	555	94.4
Female	152	38.6	242	61.4	159	39.5	244	60.5	11	2.7	391	97.3	23	5.7	380	94.3	48	11.9	355	88.1
Transgender	2	40.0	3	60.0	1	20.0	4	80.0	3	60.0	2	40.0	0	0.0	5	100.0	0	0.0	5	100.0
Sexual Orientation																				
Heterosexual	265	40.3	392	59.7	303	45.2	367	54.8	9	1.3	660	98.7	21	3.1	648	96.9	56	8.4	614	91.6
GLBQ	205	63.3	119	36.7	118	36.3	397	63.7	227	69.6	99	30.4	3	0.9	322	99.1	25	7.7	299	92.3
Race																				
White	298	46.3	346	53.7	305	46.8	347	53.2	177	27.1	475	72.9	18	2.8	633	97.2	43	6.6	608	93.4
Students of Color	163	51.7	152	48.3	106	33.0	215	67.0	57	17.8	264	82.2	6	1.9	315	98.1	37	11.5	284	88.5

[1] Vaginal, anal or oral sex within the last 12 months

[2]Men who have sex with men as well as men and women who have sex with men who have sex with men

[3]Within the last 12 months

[4]Self-disclosed previous positive STI test

Median and Interquartile Ranges of student and counselor risk assessments (Tables 5 and 6)

We computed the median and interquartile ranges (IQR) of student and HIV test counselor risk assessments according to various demographic and behavioral characteristics, and stratified by sex. Low risk is denoted by "1.0", medium risk with "2.0", and high risk with "3.0". Students across all categories assessed themselves as low risk, which is different from their HIV test counselors who assessed many students as medium risk. The median HIV test counselor risk assessment for males and females between 17-21 was medium. The HIV test counselors also found GLBQ males, White males, as well as male and female students of color to be medium risk. Both males and females with 3 or more sexual partners in the last 12 months were also medium risk.

Table 5: Student Risk Assessment

	Males		**Females**	
Characteristics	**Median Risk Assessments**	**IQR**	**Median Risk Assessments**	**IQR**
Age				
17-19	1.0	1.0-2.0	1.0	1.0-1.5
20-21	1.0	1.0-1.0	1.0	1.0-1.0
22-23	1.0	1.0-1.0	1.0	1.0-1.0
24-25	1.0	1.0-2.0	1.0	1.0-1.0
26-51	1.0	1.0-2.0	1.0	1.0-2.0
Sexual Orientation				
Heterosexual	1.0	1.0-1.0	1.0	1.0-1.0
GLBQ	1.0	1.0-2.0	1.0	1.0-1.0
Race				
White	1.0	1.0-1.5	1.0	1.0-1.0
Students of Color	1.0	1.0-2.0	1.0	1.0-1.0
# of Sex Partners[1]				
None	1.0	1.0-2.0	1.0	1.0-1.0
1-2 partners	1.0	1.0-1.0	1.0	1.0-1.0
3 or more partners	1.0	1.0-2.0	1.0	1.0-2.0

[1] Within the last 12 months

Key:
Low risk is denoted by "1.0"
Medium risk is denoted by "2.0"
High risk is denoted by "3.0"

Table 6: HIV Test Counselor Risk Assessment

	Males		Females	
Characteristics	**Median Risk Assessments**	**IQR**	**Median Risk Assessments**	**IQR**
Age				
17-19	2.0	1.0-3.0	2.0	1.0-2.0
20-21	2.0	1.0-3.0	2.0	1.0-2.0
22-23	2.0	1.0-2.0	1.0	1.0-2.0
24-25	2.0	1.0-2.0	1.0	1.0-2.0
26-51	2.0	1.0-2.0	1.0	1.0-2.0
Sexual Orientation				
Heterosexual	1.0	1.0-2.0	1.0	1.0-2.0
GLBQ	2.0	1.0-3.0	1.0	1.0-2.0
Race				
White	2.0	1.0-2.0	1.0	1.0-2.0
Students of Color	2.0	1.0-2.0	2.0	1.0-2.0
# of Sex Partners[1]				
None	1.0	1.0-2.0	1.0	1.0-1.0
1-2 partners	1.0	1.0-2.0	1.0	1.0-2.0
3 or more partners	2.0	2.0-3.0	2.0	2.0-3.0

[1] Within the last 12 months

Key:
Low risk is denoted by "1.0"
Medium risk is denoted by "2.0"
High risk is denoted by "3.0"

Student knowledge level as reported by HIV test counselor (Table 7)
According to HIV test counselors, 65.2% of students had excellent knowledge of HIV transmission routes and risk behaviors, while 27.8% and 6.7% had good and poor knowledge respectively. Across every demographic category, there was a substantially higher percentage of students with excellent knowledge as compared to those with good and poor knowledge combined. When stratified by age, the general trend was that older students had better HIV knowledge. When stratified by sexual orientation, GLBQ students were somewhat more knowledgeable (69.0% excellent, 26.1% good, 4.9% poor) than heterosexual students (63.6% excellent, 28.7% good, 7.6% poor). Students of color generally were slightly less knowledgeable (60.7% excellent, 30.5% good, 8.7% poor) than white students (67.9% excellent, 26.5% good, 5.5% poor). When looking at the number of sexual partners, students with no sexual partners in the last 12 months had the most knowledge (72.2%).

Table 7: Students' Knowledge Level Reported by HIV Test Counselor

	Excellent		**Good**		**Poor**	
Characteristics	*n=652*	*%*	*n=278*	*%*	*n=67*	*%*
Age						
17-19	124	59.6	68	32.7	16	7.7
20-21	196	64.5	88	28.9	20	6.6
22-23	145	64.7	68	30.4	11	4.9
24-25	79	74.5	21	19.8	6	5.7
26-51	108	70.6	32	20.9	13	8.5
Sexual Orientation						
Heterosexual	425	63.6	192	28.7	51	7.6
GLBQ	225	69.0	85	26.1	16	4.9
Race						
White	443	67.9	173	26.5	36	5.5
Students of Color	195	60.7	98	30.5	28	8.7
# of Sex Partners						
None	18	72.2	6	24.0	1	4.0
1-2 partners	322	64.5	140	28.1	37	7.4
3 or more partners	308	66.0	130	27.8	29	6.2
Previous HIV Test						
Yes	348	74.2	98	20.9	23	4.9
No	294	57.4	175	34.2	43	8.4

Student and HIV Test Counselor Risk Assessments (Table 8)

The results in this table can be categorized into three groups: concordant, discordant (overestimation), discordant (underestimation). The students who were concordant were those who assessed their personal risk the same as the HIV test counselor. These students represented 51.1% of the entire sample. The discordant (overestimation) students were the students who overestimated their risk by assessing their HIV risk as higher (riskier) than their HIV test counselor's assessment (e.g., students who rated themselves as medium or high risk when the HIV test counselor rated them as low risk). These students represented 6.2% of the entire sample. The discordant (underestimation) students were those who underestimated their HIV risk; these students believed they were at a lower HIV risk than what their HIV test counselor rated them (e.g., students who rated themselves as low or medium risk when the HIV test counselor rated them as high risk). They represented 42.6% of the sample.

Table 8: Self and Counselor Risk Assessments

		Counselor Risk Assessment					
		Low		***Medium***		***High***	
		n=456	*%*	*n=345*	*%*	*n=194*	*%*
Self Risk Assessment	***Low***	**401**	**40.3**	**248**	**24.9**	**102**	**10.3**
	Medium	**49**	**4.9**	**90**	**9.0**	**74**	**7.4**
	High	**6**	**0.6**	**7**	**0.7**	**18**	**1.8**
	Total						**995**

Concordant= 51.1%
Discordant (overestimation) =6.2%
Discordant (underestimation) =42.6%

Odds ratios and 95 percent confidence intervals for risk discordance with demographic and behavioral characteristics (Table 9)

Unadjusted associations between student demographic and behavioral characteristics and underestimation of HIV risk (Figure 1)

Males were more likely to underestimate their HIV risk than females in unadjusted analyses (OR: 1.411, 95% CI: 1.088 to 1.828). People of color (non-White) had significantly lower odds of underestimating risk compared to white students (OR: 0.752, 95% CI: 0.572 to 0.989). Non-Hispanic students had significantly higher odds of underestimating risk compared to Hispanic students (OR: 1.893, 95% CI: 1.024 to 3.500). GLBQ students were more likely to underestimate their HIV risk than heterosexual students (OR: 1.829, 95% CI: 1.398 to 2.391).

The students who reported having sex with MSM had significantly higher odds of underestimating risk compared to students who did not report sex with MSM (OR: 1.758, 95% CI: 1.309 to 2.361). Students who reported non-injection drug use before having sex in the last 12 months had significantly higher odds of underestimating risk compared to students who did not report non-injection drug use before sex (OR: 2.633, 95% CI: 1.558 to 4.452). Students who reported alcohol use before having sex in the last 12 months were more likely to underestimate their HIV risk than those students who were not under the influence of alcohol (OR: 2.701, 95% CI: 2.082 to 3.505).

Students with 3 or more sexual partners in the last 12 months had significantly higher odds of underestimating risk compared to those students with 0-2 partners (OR: 6.063, 95% CI: 4.592 to 8.006). Students who reported their relationship status as single or dating had significantly higher odds of underestimating risk compared to those students who were married/engaged/domestic partnership (OR: 3.874, 95% CI: 1.470 to 10.206). Students in a mutually monogamous relationship had significantly lower odds of underestimating risk compared to those students who were not in a relationship (OR: 0.565, 95% CI: 0.430 to 0.744). Students in an open or other relationship were neither more nor less likely to underestimate their HIV risk compared to those students who were not in a relationship (OR: 0.983, 95% CI: 0.614 to 1.573).

The students who have had a previous HIV test before were neither more nor less likely to underestimate their HIV risk than students who have not had a previous HIV test (OR: 1.054, 95% CI: 0.818 to 1.358). The students who reported experiencing sexual assault in the last 12 months were more likely to underestimate their HIV risk than students who did not experience sexual assault (OR: 2.415, 95% CI: 1.004 to 5.810). The students who tested positive for an STI in the last 12 months had higher odds of underestimating risk compared to those students who did not test positive for an STI (OR: 1.283, 95% CI: 0.814 to 2.022).

The students who were 20-21 years old were neither more nor less likely to underestimate their HIV risk than 17-19 year olds (OR: 0.892, 95% CI: 0.627 to 1.271). The 22-23 year old students were neither more nor less likely to underestimate their HIV risk than 17-19 year olds (OR: 0.870, 95% CI: 0.596 to 1.270). The students who were 24-25 years old

were neither more nor less likely to underestimate their HIV risk than 17-19 year olds (OR: 0.625, 95% CI: 0.404 to 1.052). The 26-51 year old students were less likely to underestimate their HIV risk than 17-19 year olds (OR: 0.418, 95% CI: 0.268 to 0.653). 2nd year students were neither more nor less likely to underestimate their HIV risk than 1st year students (OR: 0.819, 95% CI: 0.504 to 1.332). 3rd year students were neither more nor less likely to underestimate their HIV risk than 1st year students (OR: 0.847, 95% CI: 0.541 to 1.324). 4th year students had lower odds of underestimating their HIV risk compared to 1st year students (OR: 0.643, 95% CI: 0.416 to 0.995). 5th year students were neither more nor less likely to underestimate their HIV risk than 1st year students (OR: 0.656, 95% CI: 0.379 to 1.137). Graduate/professional students had lower odds of underestimating their HIV risk compared to 1st year students (OR: 0.420, 95% CI: 0.270 to 0.651).

Adjusted associations between student demographic and behavioral characteristics and underestimation of HIV risk (Figure 2)

The following variables were not included in the adjusted model: ethnicity, HIV test before, relationship status, and testing positive for STI in the last 12 months. Figures 1 and 2 are forest plots of the ORs and CIs for the unadjusted and adjusted models respectively.

The general trend between the unadjusted and adjusted models was that several variables went from being significantly associated with underestimating risk to null. Several other variables went from being protective against underestimating risk to null. There were also variables which did not significantly change directions between both models.

Following adjustment, the variables that were associated with increased odds of risk discordance are GLBQ, having sex while under the influence of alcohol in the last 12 months, having 3 or more sexual partners in the last 12 months, and experiencing sexual assault in the last 12 months.

The variables that were associated with decreased odds of risk discordance are mutually monogamous relationship and being a 2nd year, 4th year, or Graduate/Professional student.

The variables that were not associated with odds of risk discordance are sex, being non-White, being MSM or having sex with MSM, age, being a 3rd year or 5th year student, reporting being in an open/other relationship, and having sex while under the influence of non-injection drugs in the last 12 months.

Table 9: Unadjusted and adjusted ORs of the effect of student characteristics on odds of discordance

Characteristics	Unadjusted		Adjusted	
	Odds ratio	95% CI	Odds ratio	95% CI
Sex				
Female (ref)	**1.**	--	**1.**	--
Male	1.411	1.008, 1.828	0.891	0.622, 1.276
Race				
White (ref)	**1.**	--	**1.**	--
Non-white	0.752	0.572, 0.989	0.971	0.700, 1.347
Ethnicity				
Hispanic (ref)	**1.**	--	**Unable to be included**	
Non-Hispanic	1.893	1.024, 3.500		
Orientation				
Heterosexual (ref)	**1.**	--	**1.**	--
GLBQ	1.829	1.398, 2.391	1.824	1.117, 2.980
Reports sex with MSM				
Yes	1.758	1.309, 2.361	0.876	0.514, 1.493
No (ref)	**1.**	--	**1.**	--
Alcohol				
Yes	2.701	2.082, 3.505	2.095	1.518, 2.891
No (ref)	**1.**	--	**1.**	--
HIV test before				
Yes	1.054	0.818, 1.358	**Unable to be included**	
No (ref)	**1.**	--		
# sex partners				
0-2 (ref)	**1.**	--	**1.**	--
3+	6.063	4.592, 8.006	5.288	3.858, 7.249
Age				
17-19 (ref)	**1.**	--	**1.**	--
20-21	0.892	0.627, 1.271	1.299	0.679, 2.485
22-23	0.870	0.596, 1.270	1.915	0.884, 4.144
24-25	0.652	0.404, 1.052	1.969	0.815, 4.758
26-51	0.418	0.268, 0.653	0.995	0.426, 2.325

Rank				
1st (ref)	**1.**	--	**1.**	--
2nd	0.819	0.504, 1.332	0.509	0.276, 0.939
3rd	0.847	0.541, 1.324	0.602	0.280, 1.294
4th	0.643	0.416, 0.995	0.340	0.154, 0.750
5th	0.656	0.379, 1.137	0.443	0.172, 1.140
Grad/Prof	0.420	0.270, 0.651	0.305	0.127, 0.733
Relationship status				
Single/dating	3.874	1.470, 10.206		
Married/domestic partner/engaged (ref)	**1.**	--	**Unable to be included**	
Relationship type				
I'm not in a relationship (ref)	**1.**	--	**1.**	--
Mutually monogamous	0.565	0.430, 0.744	0.664	0.479, 0.920
Open relationship or other	0.983	0.614, 1.573	0.914	0.515, 1.621
Positive STI in last 12 months				
Yes	1.283	0.814, 2.022	**Unable to be included**	
No (ref)	**1.**	--		
Sexually assaulted in last 12 months				
Yes	2.415	1.004, 5.810	3.203	1.183, 8.672
No (ref)	**1.**	--	**1.**	--
Sex while using non-injection drugs in last 12 months				
Yes	2.633	1.558, 4.452	1.460	0.770, 2.768
No (ref)	**1.**	--	**1.**	--

Figure 1: Forest plot of unadjusted odds ratios and 95% CIs of the association between student demographic and behavioral characteristics and underestimation of HIV risk

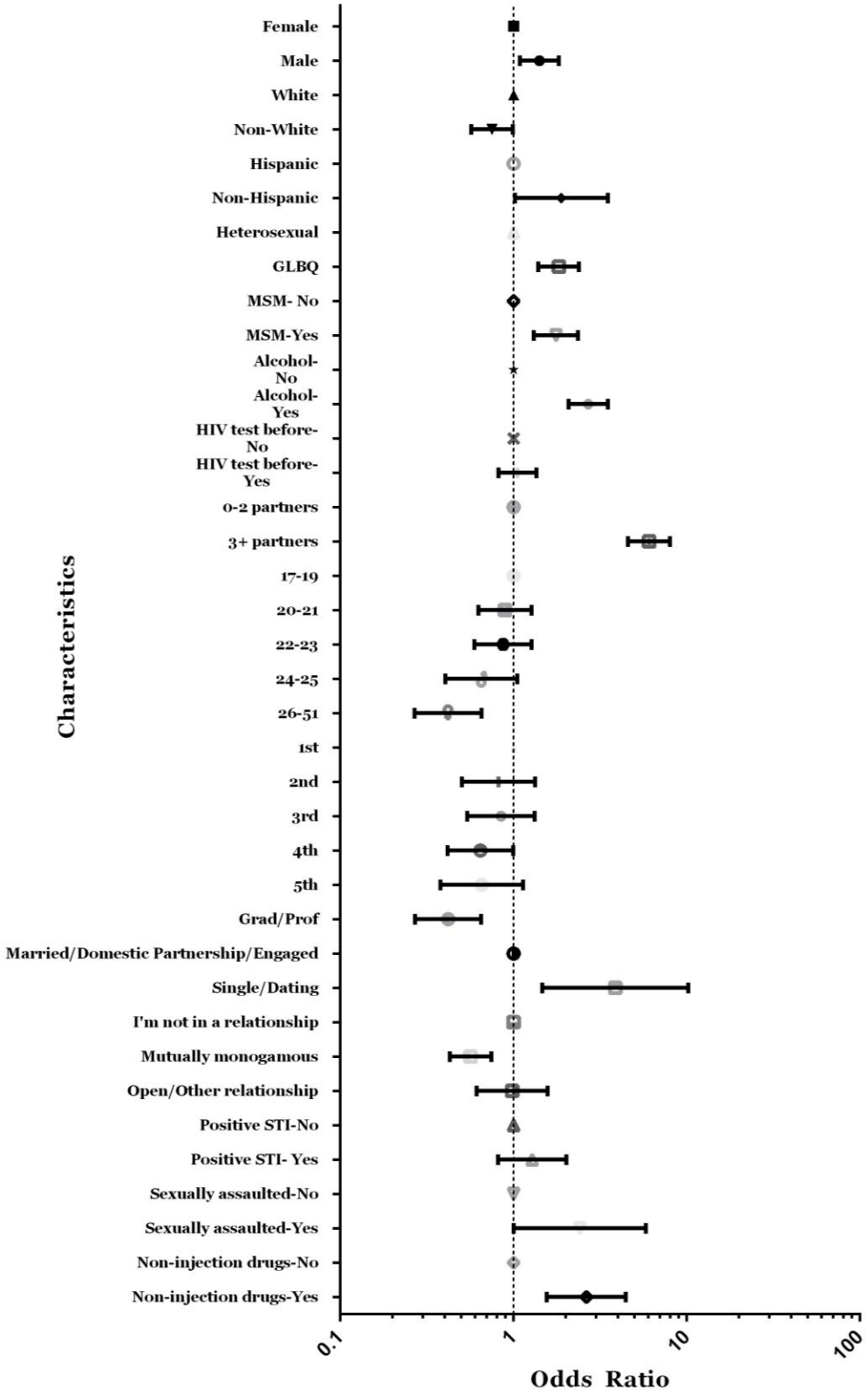
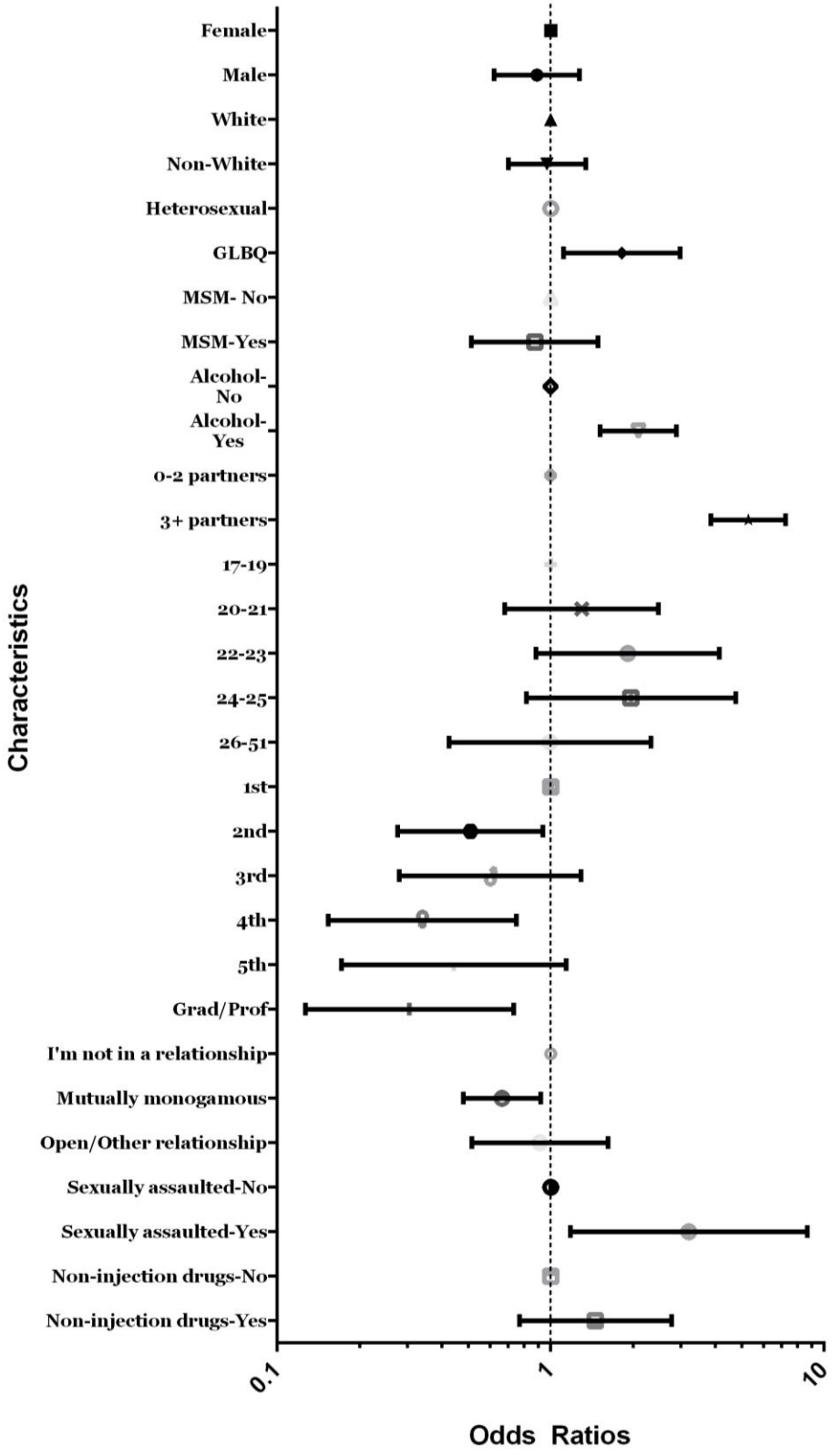


Figure 2: Forest plot of adjusted odds ratios and 95% CIs of the associations between student demographic and behavioral characteristics and underestimation of HIV risk.



Discussion

The findings in this study confirm the hypothesis that student demographic and behavioral factors may predict discordance, specifically underestimation, between student and HIV test counselor risk assessments of HIV. There has been a lack of research looking into relationships between various demographic and behavioral characteristics, self-reported behaviors, and perceptions of HIV risk among college students.

Overall the findings in this study show the students' median risk assessments as low across every demographic category support the conclusion made by Lewis et al that college students may perceive themselves at low risk for contracting HIV. Our results regarding the sexual behaviors of OSU students in this study agree with the findings in the study by Adefuye et al that students participate in unsafe sexual practices such as having multiple sex partners and having sex under the influence of alcohol and other non-injection drugs.

A greater percentage of students in this study who had tested for HIV before were more knowledgeable about transmission of the virus than those who had never had a previous HIV test. This finding supports the study by Mattson confirming that HIV-test counseling has a positive influence on HIV/AIDS education and safe sex behaviors for students who present for testing. Although more students had excellent knowledge ratings, almost half of the students in the study were discordant with their HIV test counselors. This finding agrees with both the 2004 Opt and Loffredo and the 2011 Iconis studies, which concluded that although college students are aware of high-risk behaviors that lead to HIV infection, they continue to engage in these behaviors without taking the necessary precautions.

When behavioral variables were stratified by age (Table 4), we observed that older students were more likely to have been tested for HIV before. When knowledge level was stratified by age (Table 7), the general trend was that older students had better HIV knowledge. This is likely due to the fact that older students have had more exposure to advertisements and educational programs related to HIV testing on campus. Older students, especially graduate and professional students, tend to be more concerned about their sexual health and HIV status compared to younger students who are experimenting with and exploring their sexual options in a new and freer college campus environment. Across every age category (Table 4), there was not a substantial difference between the percentage of men or women who were MSM or had sex with MSM, or those who experienced sexual assault in the last 12 months. Half of students aged 20-21 reported having sex while under the influence of alcohol, and this behavior was less common among both older (24 years and older) and younger (ages 17-19) students. This can be explained by the effects of being on a college campus and social drinking being a norm. Most of the younger students are still becoming more familiar with drinking, while the older students have already experienced the college partying lifestyle. Older students as compared to the 20-21 year olds do not drink as much or at least they do not drink before having sex.

Stratification by gender showed that more men compared to women previously had an HIV test. More men also reported having sex while under the influence of alcohol, and having sex with MSM. This finding indicates that a substantial proportion of men seeking HIV testing at SWC are MSM. More women, on the other hand, reported experiencing sexual assault and having previously had an STI. Men usually do not report experiencing sexual assault as much as women do. More GLBQ students compared to heterosexual students reported prior HIV testing and sex with men who have sex with men.

Finally, when stratified by race, more students of color reported having had an HIV test before and a past STI. However, when looking at student knowledge level (Table 7), students of color generally were slightly less knowledgeable than white students. This shows the need for the SWC to continue their targeted marketing outreach to students of color as a high risk population group. Students of color (Table 9) had lower odds of underestimating their risk, which could suggest that they are aware of their risk status as a group but could benefit more from education about HIV transmission. A higher proportion of white students, on the other hand, reported having sex while under the influence of alcohol, having sex with men who have sex with men, and having been sexually assaulted in the last 12 months.

A look at the median risk assessments of students and HIV test counselors (Table 5 and 6) shows that the students across all of the categories assessed themselves at low risk while their HIV test counselors assessed them as low to medium risk. This finding supports the hypothesis that students may underestimate their risk compared to their HIV test counselors. The following groups of students were rated as medium risk by their HIV test counselors: males and females between 17-21, GLBQ males, white males, as well as male and female students of color. Also, the males and females with 3 or more sexual partners in the last 12 months were given medium risk assessments by their HIV test counselors. We paid particular attention to these groups of students in the logistic regression analysis to see if there was an association with risk discordance.

When looking at the knowledge level of students as reported by their HIV test counselors (Table 7), across every demographic category there was a significantly higher percentage of students with excellent knowledge as compared to those with good and poor knowledge combined. These findings are related to Mattson's 2002 study which shows that students that are tested for HIV are knowledgeable about the transmission routes. When stratified by sexual orientation, GLBQ students were somewhat more knowledgeable than heterosexual students. When looking at the number of sexual partners, students with no sexual partners in the last 12 months had the most knowledge. This is an interesting finding, which could be explained by the window period of HIV testing. There are students who test within 3-6 months of a potential HIV infection. Therefore, they must return to get tested 3 and 6 months after their initial HIV test to ensure that they have ruled out the possibility of getting infected in the last three months.

The cross tabulation of the student and HIV test counselor risk assessments showed that the concordant students represented 51.1% of the entire sample, 6.2% of students overestimated their HIV risk, and 42.6% underestimated their HIV risk. This finding

reinforces the public health importance of reaching students who are underestimating their HIV risk, who would benefit from test counseling in order to decrease their risky behaviors and understand just how at risk they are of HIV infection.

Following adjustment in the logistic regression model (Table 9), the following variables were associated with decreased odds of risk discordance: students in a mutually monogamous relationship as well as 2nd year, 4th year or graduate/professional students. The variables that were not associated with odds of risk discordance are males, non-Whites, males or females who have sex with MSM, age, 3rd and 5th year students, students in open or other relationships, and students who have had sex while under the influence of non-injection drugs in the last 12 months. The variables that were associated with increased odds of risk discordance are students who are not heterosexual, having sex while under the influence of alcohol in the last 12 months, having 3 or more sexual partners in the last 12 months, and being sexually assaulted in the last 12 months.

This information can be useful for the SWC to better help them target students in the general OSU population with characteristics associated with discordance and underestimation of HIV risk. Furthermore, during HIV counseling SWC test counselors should ensure that they are adequately communicating HIV prevention messages specifically to these specific subgroups of students who appear to underestimate their HIV risk.

Study Limitations

The most important limitation of this study was the subjectivity of the HIV test counselors at OSU's SWC. The HIV test counselors are a group of students who are trained by Dr. Miller in a two-day training session based off of the Ohio Department of Health model. Although HIV test counselors are trained to follow a certain test counseling appointment model, there are always variations. As mentioned before, some HIV test counselors assess students' knowledge level before going over the consent form that includes information about HIV transmission. Other HIV test counselors will do so after going through the consent form. This limitation, therefore, affects the knowledge level variable which is why it was not extensively used in the analysis.

Another area in which HIV test counselors' subjectivity affects the variables in this study is the risk assessment. During the training as well as on the assessment form that the HIV test counselors fill out after the counseling session there are guidelines suggested by Dr. Miller which are based on the CDC's recommendations for risk assessment. After doing the QA protocol on the testing database, Dr. Miller became aware of the HIV test counselors assessing students' risk as very low, low-medium, medium-high, or very high along with the typical none, low, medium, and high assessments. Therefore, the risk assessment categories were expanded to include more in-between ratings.

Another limitation of this study is the non-representativeness of the sample compared to OSU students as a whole. The American College Health Association (ACHA) administers a yearly survey known as the National College Health Assessment (NCHA), which tracks the changes in health issues and trends in institutions of higher education.

The goal is to provide current, relevant data about college students' health in order to help enhance campus wide health promotion and prevention services. This NCHA data, however, is a flawed comparison to the findings of this study due to demographic differences of the participants in each as well as the fact that this survey was administered during 2012. The following questions were asked in the NCHA and the responses are bolded with the findings from this study in parenthesis:

Within the last 12 months, were you sexually penetrated (vaginal, anal, oral) without your consent?

1.3% (2.4%)

Within the last 12 months, with how many partners have you had oral sex, vaginal intercourse, or anal intercourse?

0=27.8 (2.5%)
1-2= 58.1% (49.9%)
3 of more= 14.1% (47.0%)

Have you ever been tested for Human Immunodeficieny Virus (HIV) infection?

No= 72.4% (51.4%)
Yes=23.2% (47.0%)

What is your sexual orientation?

Heterosexual=94.2% (67.1%)
Gay/Lesbian=2.9% (25.3%)
Bisexual=1.9% (5.4%)
Unsure=1.0% (1.2%)

What is your gender?

Female=62.0% (40.3%)
Male=36.3% (59.1%)
Transgender=0.2% (0.6%)

What is your year in school?

1st=17.9% (13.0%)
2nd=15.8% (13.2%)
3rd=16.7% (19.0%)
4th=16.6% (22.2%)
5th=5.4% (8.7%)
Graduate/Professional=26.4% (23.8%)

How do you usually describe yourself?

White=80.5% (68.8%)
Black or African American=5.5% (19.9%)
Asian or Pacific Islander=9.7% (12.0%)
American Indian or Alaskan=1.4% (1.0%)

Hispanic/Latino=3.5% (5.2%)

What is your marital status?

Single=86.1% (56.1%)
Married/Partnered= 11.4% (43.8%)

When compared to the NCHA data, the SWC tests a larger percentage of students of color and a lower percentage of white students. This is most likely due to the targeted marketing efforts by the SWC to test students of color who are considered by CDC to be an at-risk group for HIV acquisition. The comparison becomes flawed with questions such as marital status, because there are different answer choices. When comparing the students' ranks, it seems that the percentage of graduate and professional students tested at the SWC is representative of the students at OSU according to the NCHA data. The SWC tests a smaller percentage of females and a higher percentage of males and transgender students than those in the NCHA data. This is not out of the ordinary as HIV testing is marketed to males (both heterosexual and GLBQ) as they are thought to be more high risk. This is also clear in the sexual orientation breakdown of the SWC testing vs. the NCHA data where a higher percentage of GLBQ students are tested vs. heterosexual students. There is a higher percentage of students at the SWC that have been tested before for HIV and who have been sexually assaulted in the last 12 months as compared to the NCHA data. The NCHA data has a larger percentage of students with 1-2 sexual partners in the last 12 months, but a smaller percentage of students with none and 3 or more sexual partners as compared to the SWC testing database. Although this is an inconsistent comparison between the findings of this study and the NCHA data, it is still a useful comparison to see just how representative the study sample is of the general OSU student population.

The findings in this study could also be compared to the 2012 Statistical Summary, which are statistics compiled by the OSU Office of Institutional Research and Planning. The study sample includes students who tested from 1 July 2010 to 30 September 2012, while this summary is only for 2012. The information not only includes statistics about main campus and the branch campuses, but also about undergraduate and graduate/professional students. When looking at rank (Table 3), the sample was representative of the number of undergraduates (76.1% vs. 76.3% of undergraduates at OSU) as well as graduate/professional students (23.8% vs. 26.6% of graduate/professional students at OSU) (Statistical Summary 2012). When comparing sex (Table 3), the SWC tests a slightly higher percentage of males (59.1% vs. 51.5% of males at OSU), and a lower percentage of females (40.3% vs. 48.5% of females at OSU) (Statistical Summary 2012).

When comparing race and ethnicity (Table 3), the sample included a larger percentage of Hispanics (5.2% vs. 3.1% of Hispanics at OSU), African Americans (19.9% v 5.8% of African Americans at OSU), American Indians/Alaskan Natives (1.0% vs. 0.21% American Indians/Alaskan Natives at OSU), Native Hawaiians/Pacific Islanders (1.2% vs. 0.06% Native Hawaiians/Pacific Islanders at OSU), and Asians (10.8% vs. 5.4% Asians at OSU) as compared to the student demographic population as reported by the University. The sample included a smaller percentage of Whites (68.8% vs. 83.5%

Whites at OSU) relative to the percentage reported by OSU (Statistical Summary 2012). This is again most likely due to the targeted marketing efforts by the SWC to test students of color who are believed to be more high risk.

In spite of the stated limitations, the findings from this study have several implications for the targeting efforts and test counseling training at the SWC as well as college campuses health centers across the country. It is therefore important for the SWC to continue in its efforts to target students who may be at high risk of HIV and/or underestimate their HIV risk.

Future Directions

Further studies are needed to confirm these findings in other college population settings and to investigate more the demographic and behavioral characteristics associated with risk discordance. Further studies are needed to look at high risk demographic groups (i.e. GLBQ, African American, and Hispanic) and risk discordance. Findings from a study with a more representative sample of OSU students could be applied to the rest of the OSU population and be more reliably extended to college students in general.

Conclusion

In this study, we examined whether OSU students who present for HIV testing and counseling at the SWC classify their risk for HIV acquisition differently compared to what their HIV test counselor classifies them; in particular, we focused on students who *underestimated* their HIV risk. We were interested in determining specific demographic and behavioral characteristics of those students whose risk assessments were discordant with their test counselor's assessment. The findings confirmed the prevalence of risk discordance between counselors and students. The characteristics that were associated with increased odds of risk discordance are GLBQ, having sex while under the influence of alcohol in the last 12 months, having 3 or more sexual partners in the last 12 months, and being sexually assaulted in the last 12 months.

Acknowledgements

I would like to thank my advisor, Dr. Abigail Norris Turner, for her encouragement of me to experience research at Ohio State. I have appreciated her enthusiasm, guidance, passion, and patience throughout this entire process.

I would also like to thank Dr. Katye Miller of the Student Wellness Center for going above and beyond in creating the database for this study as well as assisting with the data analysis.

Finally, I would like to thank Dr. Amy Acton and Dr. Jesse Kwiek for serving on my thesis defense panel. I appreciated their questions and comments as well as their time and willingness to make this a memorable experience.

This study was partially funded by The Ohio State University Undergraduate Student Government's Academic Enrichment Grant.

References

Adedeji S Adefuye, Titilayo C Abiona, Joseph A Balogun, Mainza Lukobo-Durrell, HIV sexual risk behaviors and perception of risk among college students: implications for planning interventions, BMC Public Health, Volume 9, Issue 281, August 2009, ISN , 10.1186/1471-2458-9-281.

Branson BM, Handsfield HH, Lampe MA *et al*. Revised recommendations for HIV testing of adults, adolescents, and pregnant women in health-care settings. *Morbid Mortal Wkly Rep Recomm Rep* 2006; 55: 1–17.

Cates W Jr, Handsfield HH. HIV counseling and testing: does it work? Am J Public Health.1988;78: 1533-1534.

Centers for Disease Control: Additional recommendations to reduce sexual and drug abuse-related transmission of the human T-lymphotropic virus type Illlymphadenopathy- associated virus. MMWR 1986; 35:152-155.

Centers for Disease Control and Prevention. HIV Counseling and Testing in Publicly Funded Sites Annual Report 1997 and 1998. i-35.

Centers for Disease Control and Prevention. Kaposi's Sarcoma and Pneumocystis pneumonia among homosexual men. New York City and California. MMWR 1981;30:306-8

Centers for Disease Control and Prevention, MMWR, "Perspectives in Disease Prevention and Health Promotion Public Health Service Guidelines for Counseling and Antibody Testing to Prevent HIV Infection and AIDS," August 1987.

Centers for Disease Control and Prevention, MMWR, "Revised Recommendations for HIV Testing of Adults, Adolescents, and Pregnant Women in Health Care Settings," September 2006.

Centers for Disease Control and Prevention. Technical guidance on HIV counseling. MMWR Morb Mortal Wkly Rep. 1993;42(RR-2):11-16.

Centers for Disease Control and Prevention. Welcome to HIV Prevention Counseling. Division of STD/HIV Prevention, Center for Prevention Services. Fall 1993

Chesney MA, Koblin BA, Barresi PJ, Husnik MJ, Celum CL, Colfax G, et al. An individually tailored intervention for HIV prevention: baseline data from the EXPLORE Study. AM J Public Health. 2003;93(6):933-8. Epub 30 May 2003

Greenwald J.L, et al. A rapid review of rapid HIV antibody tests. *Current Infectious Disease Reports* 8: 125-31.

Hernandez Jeanne T., Frank J. Smith, Inconsistencies and misperceptions putting college students at risk of HIV infection, Journal of Adolescent Health Care, Volume 11, Issue 4, July 1990, Pages 295-297, ISSN 0197-0070, 10.1016/0197-0070(90)90038-4.

Hightow LB, MacDonald P, Pilcher CD, et al. The unexpected movement of the HIV epidemic in the Southeastern United States: transmission among college students, J Acquir Immune Defic Syndr.2005; 38:531-7.

Iconis R: College Students and HIV/AIDS Awareness. *American Journal of Health Sciences.* 2011, 2:1-4.

"In Their Own Words." *In Their Own Words*. National Institute of Health, n.d. Web. 28

Jan. 2013. <http://history.nih.gov/nihinownwords/docs/page_04.html>.

Kamb ML, Fishbein M, Douglas JM, et al. Efficacy of risk-reduction counseling to prevent human immunodeficiency virus and sexually transmitted diseases: a randomized controlled trial. JAMA 1998;280:1161--7.

Koblin B, Chesney M, Coates T; EXPLORE Study Team. Effects of a behavioural intervention to reduce acquisition of HIV infection among men who have sex with men: the EXPLORE randomised controlled study. *Lancet.* 2004, 364: 41-50

Lewis, J. E., & Malow, R. M. (1997). HIV/AIDS risks in heterosexual college students. *Journal of American College Health, 45*, 147-159.

Mattson M: Impact of HIV test counseling on college students' sexual beliefs and behaviors.*Am J Health Behav* 2002, 26:121-136.

Opt S, Loffredo D (2004). College students and HIV/AIDS: more insights on knowledge, testing, and sexual practices. J. Psychol. 1359: 389-403

Raab GM, Burns SM, Scott G, et al. HIV prevalence and risk factors in university students. *AIDS.* 1995;9:191-197.

Statistical Summary 2012. The Ohio State University Office of Institutional Research and Planning. http://www.osu.edu/osutoday/stuinfo.php#enroll_large

Weinhardt LS, Carey MP, Johnson BT, Bickham NL. Effects of HIV counseling and testing on sexual risk behavior: a meta-analytic review of published research, 1985--1997. Am J Public Health 1999;89:1397-405.